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EMPLOYMENT SURVEY 1984

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Physics is a complex professional discipline; students who choose this scientific career do so at different stages of their education. This report discusses the initial employment of physics and astronomy degree recipients and relates a variety of characteristics to the graduates at three different degree levels. Two surveys conducted by AIP each summer identify the career goals of physics graduates at the doctoral, master's and bachelor's levels and single out the employment-oriented degree recipients. Six months later we schedule the Employment Survey, thereby allowing the graduates of the academic year that ended on the previous June 30 to find and/or evaluate their initial employment.

An important question raised in connection with initial employment is, "How much time do graduates require to secure their first positions?" **Figure 1** presents four time periods during which graduates at each of three degree levels accepted employment. 'Postdocs' are excluded from the doctoral graduates so as to focus on potentially permanent positions comparable to those sought by the masters and bachelors. The first time period—< 1 month— is intended to call attention to graduates who have positions already lined up when their degrees are conferred. For the graduates of the class of 1984, 40% of the bachelors, 37% of the masters and 15% of the doctorate recipients fell into that category. However, a signifi-

Fig. 1. Time spent by 1984–85 physics degree recipients in securing employment.

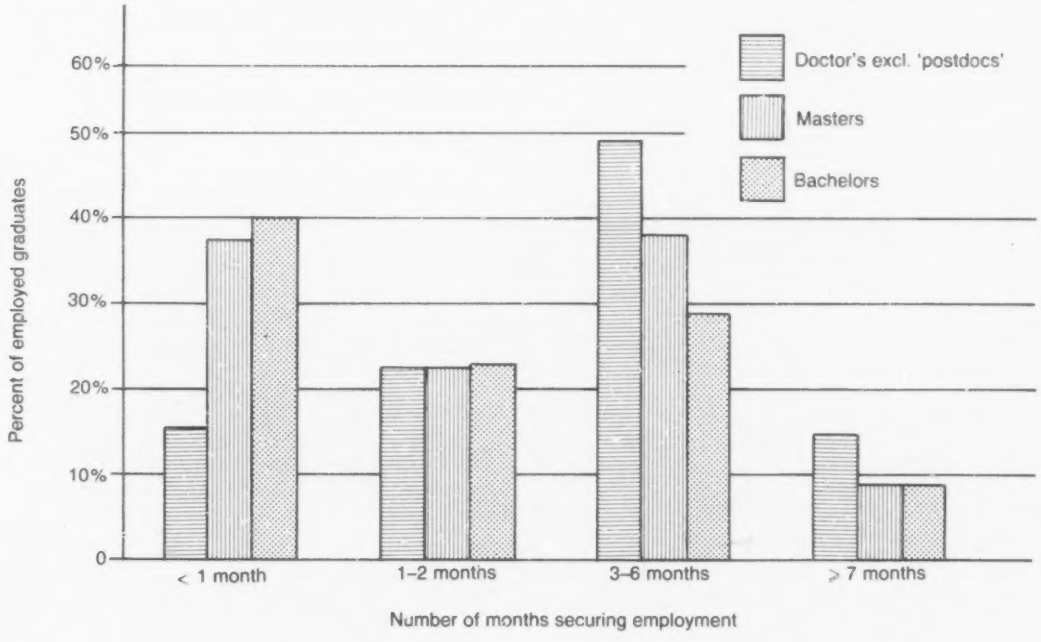

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Table I. Changes in occupational status of physics degree recipients between the summer of 1984 and the following winter.

Doctors		Occupational status, winter 1984–85: 'Postdoc' or student	Employed full-time permanent	Employed part-time temporary other	Not employed and seeking	Total N	Total %
Newly accepted empl.		6	156	2	–	164	38
Continuing employment		3	27	1	–	31	7
'Postdoc'		190	16	1	–	207	48
Return to foreign country		4	5	1	–	10	2
Other		2	1	3	–	6	1
Not empl. and seeking		6	8	–	3	17	4
Total respondents	N	211	213	8	3	435	
	%	49	49	2	– (½%)		100%
Masters							
Newly accepted empl.		–	71	–	–	71	52
Continuing employment		1	27	–	–	28	20
Return to foreign country		3	1	–	1	5	4
Other		9	3	–	–	12	9
Not empl. and seeking		–	15	–	6	21	15
Total respondents	N	13	117	–	7	137	
	%	10	85	–	5		100%
Bachelors							
Newly accepted empl.		7	322	1	2	332	44
Continuing employment		2	76	1	6	85	11
Military service		2	66	1	2	71	9
Empl. & seeking (inc. summer)		11	111	16	36	174	23
Will be seeking		4	7	2	3	16	2
Not empl. and seeking		1	56	1	22	80	11
Total respondents	N	27	638	22	71	758	
	%	4	84	3	9		100%

Employment status reported by physics degree recipients, summer 1984

cant dividing line on the time scale appears to be "three months". Ever since the late 1970's a majority of the doctoral physicists require at least three months to secure employment whereas most non-doctoral physicists secure initial employment in less than three months.

Tables I and **II** outline the major objective of this follow-up survey; namely to determine the extent to which the occupational status of new graduates changes in a six-month period. Each table has three parts which correspond to the three degree levels. The first column of each table lists the occupational status as reported by the physics and astronomy graduates in the summer of 1984. Thus, from **Table I**, which deals with the physics graduates, we note that 38% of the doctorate recipients had secured permanent employment, 48% had accepted 'postdocs', and 4% were still seeking suitable employment. Six months later, during the winter of 1984–85 the proportion holding 'postdocs' remained the same while potentially permanent employment was reported by 49% and only three of the new doctoral physicists were not yet employed and still seeking positions.

Three bachelors were the only astronomy degree recipients who classified themselves as "not employed and seeking" at the time of the earlier survey, and **Table II** shows that all three found full-time employment within the six-month period between surveys.

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Table II. Changes in occupational status of astronomy degree recipients between the summer of 1984 and the following winter.

Employment status reported by astronomy degree recipients, summer 1984	Occupational status, winter 1984–85						
Doctors	'Postdoc' or student	Full-time employed	Employed part-time temporary other	Not employed and seeking	Total N	Total %
Full-time employment	1	13	2	–	16	29
'Postdoc'	31	4	–	–	35	64
Other	–	2	2	–	4	7
Total respondents N	32	19	4	–	55	
Total respondents %	58	35	7	–		100%
Masters						
Newly accepted employment	–	5	–	–	5	83
Continuing employment	–	1	–	–	1	17
Total respondents N	–	6	–	–	6	
Total respondents %		100%				100%
Bachelors						
Full-time employment	–	6	–	–	6	50
Temporary employment	–	1	–	2	3	25
Not employed and seeking	–	3	–	–	3	25
Total respondents N	–	10	–	2	12	
Total respondents %	–	83		17		100%

As the demand for doctorate-level physicists increases, traditional patterns change. For example, physicists whose dissertations were based on experimental work were more likely to be offered potentially permanent positions, whereas theoreticians were more likely candidates for 'postdocs'. According to **Table III**, this pattern has become more pronounced because it now begins to include the new experimentalists who were foreign. Among this group, for example, the approximate 1:1 ratio of the "full-time employed" versus the 'postdocs' [43% to 51%] in 1984 represents a shift from a 1:3 ratio in the previous year. A further indication of the increasing demand is the extremely small number of new physicists who were still seeking employment at the time of the follow-up survey.

Table III. Occupational status of experimental and theoretical physicists by type of dissertation research, 1984–85*.

Occupational status	Experimentalists U.S.	Experimentalists Foreign	Experimentalists Total	Theoreticians U.S.	Theoreticians Foreign	Theoreticians Total
Full-time employed	53%	43%	52%	51%	22%	41%
'Postdoc'	45	51	45	48	76	57
Other	1	4	2	1	2	2
Unemployed and seeking	1	2	1	-	-	-
	100%	100%	100%	100%	100%	100%
Total N	274	47	321	73	37	110
Total %			74			26

**4 Doctors did not specify type of research.*

Table IV. Characteristics of postdoctoral and full-time employed physics and astronomy doctorate recipients, 1983–84.

Physics			Astronomy		
Characteristics	'Postdocs'	Full-time employed	'Postdocs'	Full-time employed	Characteristics
Sex					Sex
Female	13%	6%	9%	16%	Female
Male	87	94	91	84	Male
Age					Age
26 or younger	7%	4%	12%	–	26 or younger
27 years	13	6	16	12%	27 years
28 years	20	13	12	17	28 years
29 years	17	20	16	12	29 years
30 years	12	16	16	12	30 years
31–32 years	15	14	25	39	31–32 years
33 or older	16	27	3	8	33 or older
Citizenship					Citizenship
U.S.	75%	87%	94%	68%	U.S.
Foreign	25	13	6	32	Foreign
Type of research					Type of research
Experimental	63%	82%	74%	63%	Experimental
Theoretical	37	18	26	37	Theoretical
Major subfields of dissertation					Major subfields of dissertation
			16%	–	Astrophysics
Astrophysics	8%	4%	34	14%	Cosmology, extragalactic, quasi-stellar objects
Electron, atomic & molec.	10	4	3	7	Galactic structure, stellar motions
Elementary particles	14	4	6	14	Stellar atmospheres & spectra, stellar evolution, solar & stellar interiors
Nuclear	9	5			
Optics	3	12	9	–	Interstellar matter & gaseous nebulae
Plasma, fluids	3	6	13	14	Solar systems
Solid state	34	28	19	51	Other subfields
Number of respondents	211	213	32	19	

Each of the first three tables distinguishes between temporary postdoctoral and permanent full-time initial employment. **Table IV** carries this analysis one step further by examining five characteristics of physicists and astronomers to see which ones continue to influence the type of initial employment. For example, both astronomers and physicists who accepted 'postdocs' were younger. Citizenship, sex, and type of research appear to be influential characteristics too, but only the numbers of new physicists, among the respondents, are large enough to elaborate further. Thus, **Table IV** shows that physics 'postdocs' include more foreign citizens, more women, and more theoreticians. Also, their dissertation subfields have influenced the type of initial employment. Applied subfields, such as optics or the search for new sources of energy in plasma research, have made offers for permanent employment more likely. On the other hand specialties like elementary particles or astrophysics tend to attract postdoctoral fellowships.

Although the questions directed at physicists and astronomers are similar, the ten-to-one ratio among the respondents makes a detailed examination of the characteristics of astronomers no longer meaningful. Hence **Figure II** includes only physicists and explores further the differences between 'postdocs' and those with potentially permanent employment.

Postdoctoral fellowships are not only temporary but also low paying; however, these drawbacks are offset by giving the graduates the opportunity to continue the research of their dissertations or related areas of their choosing. Among the 211 postdoctoral respondents shown in **Figure II**, 81% said that they specifically sought a 'postdoc' and 22% of that group declined offers with potential permanence to accept those temporary fellowships.

When looking for potentially permanent positions, underemployment is frequently a concern. Thus, in response to questions dealing with the extent to which new doctoral physicists utilize their physics training, we find reassuring data which are presented in the right-hand branch of **Figure II**. These data indicate that not only did 84% of that group accept physics-related positions, but almost half of them (47%) worked in the subfields of their dissertations. The proportion of new physicists who enter new areas of research unrelated to physics is small.

Having presented the proportions of 'postdocs' and graduates with potentially permanent positions that work in the same or a different subfield, **Table V** continues this comparison by focusing on the specific subfield mobility. The major dissertation subfields are listed and matched against the subfields associated with the respective types of initial employment. Thus the upper half of the table dealing with 'postdocs' shows high percentages along its diagonal with mathematical physics representing the exception. By contrast, the lower half of **Table V** illustrates the adaptability of new physicists; five dissertation subfields are matched against a range of subfields of employment, several of them are grouped under "other."

Fig. II. Employment status of 1984–85 doctoral physicists 6–18 months after graduation.

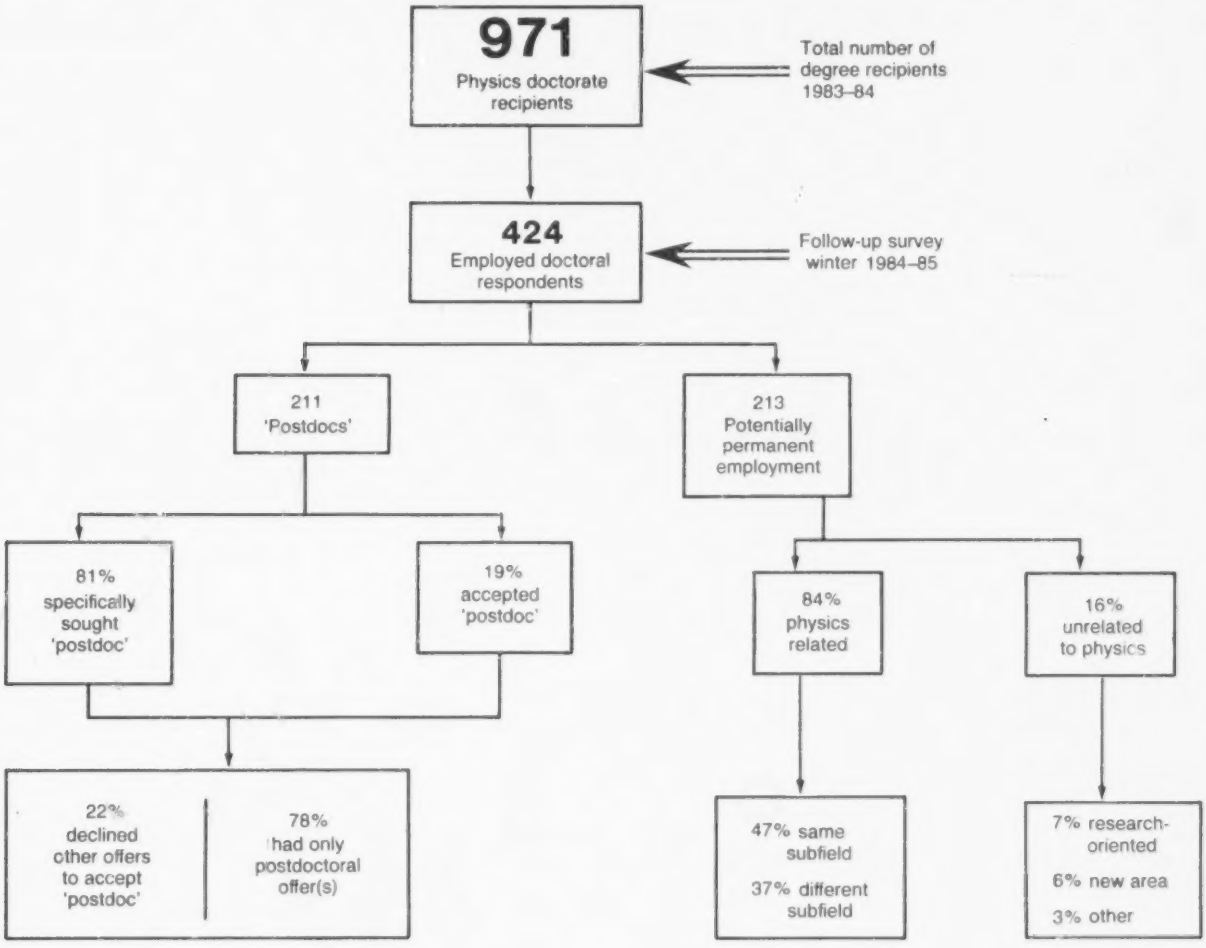

Table V. Subfield mobility of doctoral level physicists, 1983–84.

Major subfields of dissertations	Subfields of 'postdoc'							
	Astrophysics	Electron, atomic & molecular	Elementary particles	Mathematical physics	Nuclear	Solid state	Other	Total respondents
Astrophysics	88%	–	–	–	–	–	12%	17
Electron, atomic & molec.	–	81%	–	5%	5%	–	9	21
Elementary particles	–	–	93%	4	–	–	3	30
Mathematical physics	–	13	19	50	–	6%	12	16
Nuclear	–	–	–	–	94	–	6	17
Solid state	–	–	–	1	–	84	15	80
								181

Major subfields of dissertations	Subfields of potentially permanent employment								
	Elem. particles	Nuclear	Optics	Plasma, fluids	Solid state	Applied physics	Education	Other	Total respondents
Elementary particles	35%	5%	–	5%	–	10%	10%	35%	20
Electron, atomic & molec.	–	17	17%	–	–	17	8	41	12
Nuclear	–	38	8	–	–	8	15	31	13
Plasma, fluids	–	–	25	50	–	25	–	–	12
Solid state	–	–	9	–	63%	12	4	12	67
									124

Table VI. Employment with potential permanence accepted by 1983–84 doctorate recipients.

		Type of employer						Total	
		Univ.	4-yr. coll.	Industry	Gov't	FFRC	Other	N	%
Subfield of Ph.D	Cross disciplinary	6	–	8	1	–	1	16	7
	Elec., atomic, molec.	2	2	11	3	1	–	19	9
	Elem. particles	8	2	8	–	6	1	25	12
	Nuclear	3	2	3	3	1	1	13	6
	Optics	1	1	7	2	–	1	12	6
	Plasma	3	–	7	2	1	–	13	6
	Solid state	12	3	45	8	6	1	75	35
	Other	3	2	26	6	1	2	40	19
Work activity	Teaching	6	6	–	–	–	1	13	6
	Research	11	–	21	10	8	2	52	24
	Teaching & research	14	5	–	–	–	–	19	9
	Res./dev./design	4	–	73	13	7	1	98	46
	Other	3	1	21	2	1	3	31	15
Physics related work	Same subfield	30	5	41	12	10	3	101	47
	Different subfield	7	6	49	9	6	2	79	37
Unrelated to physics	Research-oriented	–	–	11	3	–	–	14	7
	New area	–	–	10	1	–	2	13	6
	Other	1	1	4	–	–	–	6	3
Interested in a job change	Yes	12	5	14	4	–	1	36	17
	No	22	4	88	15	14	4	147	69
	Unsure	4	3	13	6	2	2	30	14
	Total respondents N	38	12	115	25	16	7	213	
	Total respondents %	18	6	54	12	7	3		100%

Since the questionnaire for this survey reaches the new physicists anywhere from six to eighteen months after graduation, it seemed appropriate to request an evaluation of their initial employment. The answers to such questions, addressing the doctorate recipients, are summarized in **Table VI** and related to five distinct types of employers. When compared with the previous year's data, a three percentage-point decrease in physicists with cross-disciplinary specialties can be observed, and "computer science" is no longer listed among the work activities because fewer than ten respondents reported this activity in connection with industrial employment.

Nondoctoral physics graduates

Only the masters and bachelors were asked about the methods they employed to secure their first positions. It was a new multiple choice question that evoked many comments and additional choices. A summary of the responses is presented in **Table VII**. Placement services, chosen by more degree recipients than any other method, referred primarily to those operated by a college or university. "Personal" contacts, on the other hand, included friends or family as well as faculty members. Both masters and bachelors who used this method to secure their first positions cited friends more frequently than professors.

Table VII. Methods used by new masters and bachelors who seek employment.

	Placement service	Personal contacts	Responses to journal or newspaper advertisements	Previous employers (inc. summer)	Distribution of resumés	Multiple approaches	Military
Masters	26%	17%	15%	9%	19%	11%	3%
Bachelors	28	10	16	8	15	13	10

Table VIII. Characteristics of 1983–84 physics masters that influence the time required to secure employment.

Characteristics		Time spent finding employment					Total	
		< 1 mo.	1–2 mos.	3–6 mos.	7–12 mos.		N	%
Sex	Female	38%	24%	38%	–	100%	17	16
	Male	37	22	31	10%	100	103	84
Age	23 or younger	14%	14%	58%	14%	100%	7	6
	24 years	19	28	48	5	100	21	17
	25 years	25	35	35	5	100	19	16
	26 years	42	11	42	5	100	19	16
	27–28 years	33	29	29	9	100	24	20
	29 or older	53	10	27	10	100	30	25
Type of graduate institution	Doctorate-granting	35%	20%	35%	10%	100%	92	77
	Master's-granting	43	25	25	7	100	28	23
Type of employment	Physics related	40%	21%	33%	6%	100%	113	94
	Unrelated to physics	29	29	29	13	100	7	6
Major employer	Industry	27%	27%	31%	15%	100%	64	54
	Gov't/military	46	4	46	4	100	24	20
	Coll./univ.	67	13	20	–	100	15	13
Major work activity	Teaching	62%	19%	19%	–	100%	21	18
	Res., dev. or design	34	23	31	12%	100	70	59
Total respondents	N	45	26	40	9		120*	
	%	37	22	33	8			100%

Three masters from the "student" category in Table I qualified for inclusion in this table along with the full-time employed.

To supplement the overall comparison among degree recipients shown in **Figure I, Table VIII** focuses only on new physics masters and examines the possibility that any of six characteristics may influence the "time spent finding employment." More than one-third of the masters fall into the first category on the time scale, "< 1 month" because they include those graduates who studied on a part-time basis and continued to work for the same employer who helped finance the education. A majority of the masters aged 29 or older fall into this time category while less than 20% of those aged 24 or younger are part of that group.

Sex does not seem to be a characteristic that influences the amount of time spent to find employment. On the other hand, the types of employers and corresponding work activities do influence the amount of time required. For example, teaching positions at academic institutions are usually arranged well in advance; hence a majority of the masters interested in that profession fall into the shortest time category.

Table IX. Characteristics of the 1983–84 physics bachelors that influence the time required to secure employment.

Characteristics		Time spent finding employment: <1 mo.	1–2 mos.	3–6 mos.	>7 mos.		Total: N	%
Sex	Female	42%	25%	25%	8%	100%	108	16
	Male	40	23	30	7	100	552	84
Age	21 or younger	50%	20%	25%	5%	100%	20	3
	22 years	39	23	31	7	100	251	38
	23 years	43	22	27	8	100	158	24
	24–25 years	31	30	28	11	100	99	15
	26–29 years	40	19	37	4	100	79	12
	30 or older	60	16	16	8	100	53	8
Type of bachelor's institution	Doctorate-granting	40%	23%	29%	8%	100%	290	44
	Master's-granting	40	18	34	8	100	73	11
	Bachelor's-granting	40	24	28	8	100	297	45
Type of employment	Physics related	40%	25%	28%	7%	100%	440	67
	Unrelated to physics	47	21	25	7	100	220	33
Region of bachelor's institution	Northeast	40%	24%	28%	8%	100%	192	29
	Southeast	44	23	26	7	100	112	17
	Midwest	39	22	29	10	100	106	16
	Southwest & Mountain	40	18	34	8	100	92	14
	Pacific	39	25	30	6	100	158	24
Major work activity	Res., dev. or design	40%	20%	32%	8%	100%	211	32
	Programming	36	31	28	5	100	124	19
	Teaching	40	35	21	4	100	48	7
Total respondents	N	264	152	191	53		660	
	%	40	23	29	8			100%

When examining the physics bachelors we look at graduates who are less mobile and are primarily interested in two types of employers, industry and the military. In view of their lesser mobility, it seemed appropriate to include the regions of the bachelor's institutions among the characteristics examined in **Table IX** along with the types of bachelor's institutions, but neither characteristic appeared to have an influence on the time scale. As in previous years, two-thirds of the physics bachelors secure their initial employment within a two-month period and all six characteristics do little to influence that time scale significantly.

New astronomy bachelors

Only 56 institutions in the U.S. offer a bachelor's degree in astronomy, and most of those degree recipients are interested in graduate work instead of immediate employment. Consequently the number of astronomy bachelors who responded to two surveys and gave employment information was low. **Table X** includes only twelve bachelors, five of whom accepted initial employment in industry. The median salary shown in the table is $1750 per month but the range extends from $1100 for programming at a university to $2300 paid by industry for research and development work.

Table X. Employment of 1983–84 astronomy bachelors.

Work activity	Industry	Gov't incl. military	Educational institution	Total N	Median monthly salary
Programming	1	1	2	4	$1750
Res./dev./des.	3	1	–	4	
Technician	1	1	2	4	
Total respondents	5	3	4	12	